HOME COMPOSTING

INFORMATION KIT

Ontario

Ministry of the Environment

Waste Management Advisory Board

HOME COMPOSTING

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Prepared by T. Fabricius and A. Willock, Experience '79 students while working on Phase III of the Home Composting Pilot Project for the Waste Management Advisory Board.

This information kit on home composting is intended as a working document for those individuals interested in do-it-yourself home composting.

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The Benefits of Compost

Garden Waste

Kitchen Waste

Compost

enhances microbial activity

replenishes valuable decomposer organisms

increases proportion of essential organic matter in soil

combined with minerals in soil

decomposition

compost provides a continuous balance of essential nutrients needed by plants [nitrogen (N), potassium (K) phosphorus (P), calcium magnesium, iron, copper etc.]

ensures a steady supply of plant food readily absorbed by lawns, shrubs, vegetables and flowers

reduces or eliminates need for commercial NPK fertilizer

decomposition

compost holds nutrients in a readily available form for growing plants

decomposition

compost creates an ideal crumbly soil structure

increases air spaces

increases capacity of soil to retain water

water no longer drains away from sandy soil as rapidly

increases capacity of soil to absorb water

loosens clay soil by opening pore spaces

allows plant roots to develop and penetrate soil extensively

raises resistance of plants and soil to drought and erosion by wind and water

reduces or eliminates need for commercial soil conditioner

decomposition

compost makes minerals already present available to plants

utilizes 35% of total residential waste stream

reduces total output of solid waste

reduces municipal collection and disposal costs

lessens burden on landfill sites and conserves valuable land

makes your individual action a part of the solution to the solid waste problem

THE ADVANTAGES OF COMPOSTING

Composting Helps Solve the Solid Waste Problem:

- you can reduce the amount of garbage that you put out for collection by up to 35% just by composting your food and garden wastes;

- by composting you will lessen the need for new disposal sites, which use up valuable land;

- by composting you will be recycling and putting back into productive use your kitchen and yard wastes;

- by removing the organic fraction from the solid waste stream you are helping to reduce municipal collection and disposal costs.

The End Product is a Soil Nutrient and Conditioner:

- compost provides a constant, free supply of a well balanced and structured material which will enhance the productivity and stability of your garden soil;

- compost contains a balanced source of nitrogen, phosphorus and potassium as well as calcium, magnesium, iron, copper and zinc which are gradually released into the soil producing strong healthy plants resistant to insects;

- compost creates a rich crumbly soil structure which facilitates the circulation of water and air allowing the plant roots to develop and penetrate the soil extensively, and raising the resistance of plants and soil to erosion by wind and water;

- by adding compost to clay soils, you will increase its ability to absorb water;

- by adding compost to sandy soil, water will no longer drain away as rapidly;

- composted soil will improve the quality and increase the yield of your vegetables.

FACTS

FOR ENVIRONMENTAL STUDIES

ECOLOGY OF COMPOST

A Public Involvement Project

Ontario

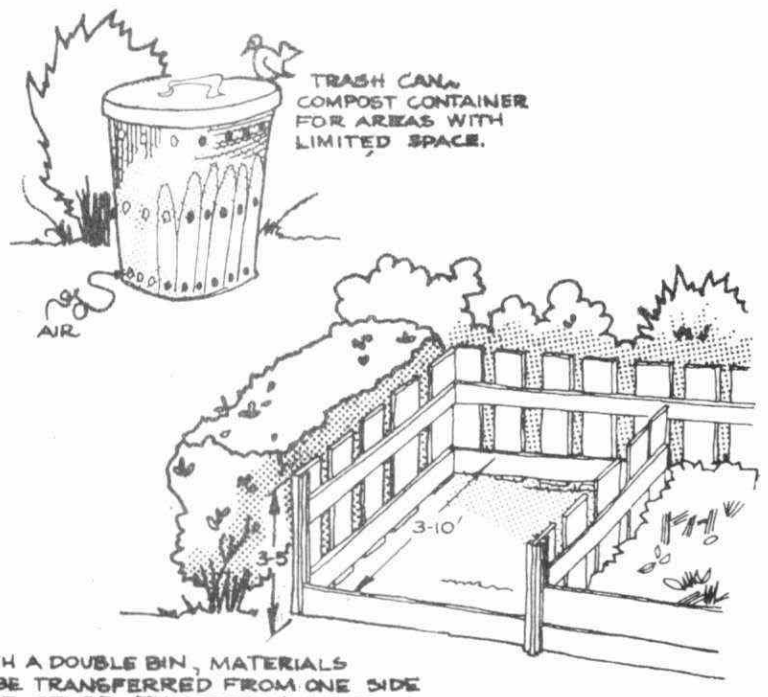
Ministry of the Environment

Hon. Harry C. Parrott, D.D.S.
Minister

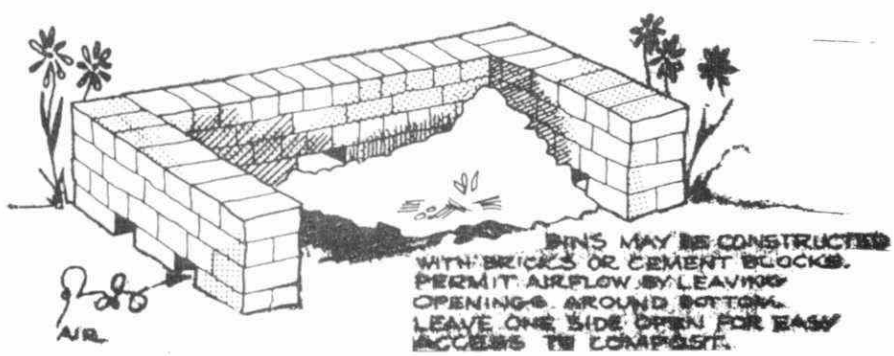
Graham W. S. Scott
Deputy Minister

OUR SOLID WASTE PROBLEM

Man has always produced solid wastes! Today, however, waste production is greater since there are many more people. More garbage is produced and more discarded products accumulate from our way of life. The "no deposit-no return" practice is convenient for a moment but "throw-away" objects and convenience packaging materials finally become a large part of our solid waste problem. They accumulate mainly because they are not easily "broken down" or degraded.



WITH A DOUBLE BIN, MATERIALS MAY BE TRANSFERRED FROM ONE SIDE TO THE OTHER. THIS STIMULATES AERATION.



BINS MAY BE CONSTRUCTED WITH BRICKS OR CEMENT BLOCKS. PERMIT AIRFLOW BY LEAVING OPENINGS AROUND BOTTOM. LEAVE ONE SIDE OPEN FOR EASY ACCESS TO COMPOST.

Illustrations by Dr. Dindal

Other sources of solid waste are meat and vegetable materials from our kitchens. Garbage ground up in kitchen disposal units drains away and is quickly forgotten because we as individuals no longer deal with it directly. Again, however, disposed items may haunt us as a community when they reappear at overburdened sewage disposal facilities, or they may be expelled untreated into our lakes or streams as organic pollutants. Also, a variety of unused natural materials are discarded from our lawns, yards and gardens. These domestic organic wastes of kitchen and lawn trimmings comprise 18 to 30 percent of our nation's solid waste materials.

Cities and towns everywhere are trying to solve their solid waste problem. Proper disposal or utilization of solid wastes will cost more money. And, as we know, governmental budgets are strained to their limits. What is the solution?

Take some individual action! Assist in a small way by using household wastes for other purposes. Follow the recycle-reuse principle which occurs naturally. In fields and forests, plants fall to the ground, decay and release vital nutrients that may be used by other plants and even animals. Also, animals die, decay and chemical substances in their bodies are reused and recycled as nutrients in the soil system.

This same recycle-reuse pattern can be employed with your household wastes. You can reuse garbage and lawn trimmings by recycling them back into your land. Your soil will benefit and your involvement can aid in a small way in solving this major solid waste problem.

ENHANCE YOUR BACKYARD — AN ECOLOGICAL COMMUNITY

Nowadays people are becoming aware of how all living organisms (plants, animals and man) are interrelated to the physical and chemical environment in which they live. Study of these relationships of organisms to the environment is known as **ecology** — a word coined by a biologist in 1866. Today, ecology is a popular word which has taken on various meanings. However, in this booklet the original definition accepted by ecologists is used.

Living organisms found in an area are known collectively as an **ecological community.** Look around your home. What organisms make up the ecological community in your backyard? Probably you did not include a common but tiny community or **microcommunity** existing within the soil itself. Organisms in the soil microcommunity are so dynamic that some people speak of soil as being "alive." You can enhance this biological activity with the use of household wastes which will increase the organic matter in soil.

Organic matter is a vital part of soil. This material must be present for the microcommunity to function properly. Also, organic matter combines physically and chemically with minerals in the soil making an ideal crumbly structure. This kind of soil structure results in an increase of air spaces and water holding properties. Increased water holding capacities in turn permit the soil and plants to withstand drought conditions much better. But so many of man's activities disturb the functions of organic matter in soil. For example, construction operations often cause layers of organic matter to be buried deeply below the surface. Raw mineral soil or subsoil is exposed, and advantages of organic matter are lost. Until the organic matter is renewed, plants grow with difficulty. If you live in a new housing development and have this kind of problem, start a household waste recycling project to improve your soil.

The major thrust of your recycle-reuse project should be composting. Composting consists of mixing your household wastes together in the proper way and allowing them to decay. Resulting mixtures or composts are worked into soil around shrubs, in gardens or potted plants in the same way as organic matter is incorporated naturally in forests and fields. For years organic gardeners have used this method with much success.

The main force behind successful composting is proper decomposition. Most chemical decomposition occurs naturally by numerous microorganisms (bacteria, molds or fungi, actinomycetes and protozoa). Tiny invertebrate animals such as mites, millipedes, insects, sowbugs, earthworms and snails are primary agents of physical decay. They break up waste debris and transport microorganisms from one

site to another. All these organisms are known as **decomposers.** They get their energy for life from digesting dead or decaying organic residues. They also cause plant and animal debris to be finely decomposed until it is no longer recognized as waste or garbage. Thus, interactions of the soil microcommunity will change your waste materials into a valuable soil constituent.

THE COMPOST PILE

Construction

Select an inconspicuous site on your lot where organic debris may be piled. Perhaps you can use an area behind a hedge row or garage or beside the garden. A heap, a pit, a variety of enclosures or open bins may be used for compost production. Use a large garbage can, a wooden box or a barrel if your space is limited. If space is no problem, the pile may vary from 3 to 10 feet wide and have an optimum height of 3 to 5 feet. Any convenient length is suitable. Also, be sure to make openings in containers for proper aeration. Where winters are extreme and summers dry, make compost in 12- to 14-inch deep pits in the soil. Compost in pits stays warmer in winter and remains damp in the summer. Finally, if you use a bin, no floor is needed, and it should have one end with removable sides for easy access in adding and turning organic matter.

Necessities for Successful Compost

Energy source

Waste residues are the major source of energy for decomposer organisms. Any of the following natural residues can be composted with the proper care:

- kitchen garbage
  - vegetable and fruit peelings
  - coffee grounds
  - egg shells
  - clam and oyster shells
  - peanut and nut shells
- leaves
- grass clippings
- weeds
- garden residues
- straw and hay
- sawdust
- manure
- pet wastes
- newspaper
- soybean meal
- cottonseed meal
- bone meal
- dried blood
- sewage sludge
- barbecue grill residues

Rates of decomposition will be increased if these items are ground up before using them. Rotary mowers can be used for shredding leaves and plant parts, especially if equipped with a mulcher. Cornstalks, hay, weeds and straw should be no longer than 6 inches in length. Newspaper should be cut into small shreds or pieces. Some people even chop or grind up garbage before adding it to the pile. Grinding increases the surface area and provides more space for decomposers to feed and grow.

Many methods for adding materials to compost heaps have been used. Some people add materials whenever it becomes available. Using this method you must mix different residues thoroughly. Do not add any one substance too thickly. For instance, sawdust and other finely divided materials easily become matted and prevent adequate circulation of air. Other people organize layers of debris as illustrated. In either case the pile must be turned and mixed periodically so that decomposition is complete. Wastes that are not decayed should be worked toward the center. The temperature within the pile indicates when the heap should be turned. Thrust a thermometer into the center of the pile and turn the residues when the temperature is near 150°F. Usually when ground or shredded materials are used, this temperature is reached every 3-4 days. Larger pieces of debris require more time, 3 to 6 weeks, before they should be turned.

C:N ratio and nutrients

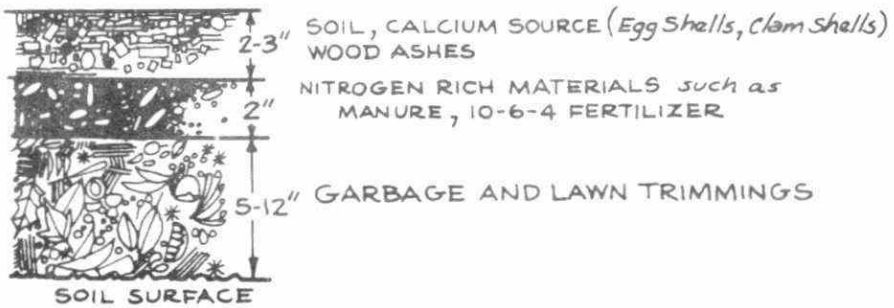
Decomposers require not only a carbon (C) source for energy but also a source of nitrogen (N) in order to multiply and completely decay waste materials. An ideal C:N ratio for most soil microorganisms ranges from 15:1 to 30:1. That is, for every 15 to 30 parts of carbon 1 part nitrogen must be present for soil flora and fauna to thrive. Most household wastes that you will use have a carbon-nitrogen content between 30:1 and 40:1. Straw has a C:N ratio of 80:1, while conifer needles and saw dust have higher ratios of 66:1 to 113:1. When ratios are high, nitrogen must be added in some form in order to attain the ideal 15:1 to 30:1 ratio. Organic gardeners use natural sources of nitrogen such as manure and urine (0.5 to 5%N), sewage sludge (1% N), parts of leguminous plants (1.5-4% N), peanut shells (3-4% N), dried blood (10% N) and soybean or cottonseed meal (7% N). The last three items are often available in garden stores. When using leguminous plants (clover, alfalfa, beans) as the nitrogen source, mix one part of them with two to three parts of non-leguminous waste material.

Potassium (K) and phosphorus (P) are also present in small but sufficient amounts in all of the above natural materials. These additional nutrients, potassium and phosphorus, become incorporated in the compost and increase the value as a fertilizer.

Commercial fertilizer is an alternate source of nitrogen. The combination fertilizer, 10-6-4 (N-P-K), has been used successfully in composting. Urea fertilizer as a nitrogen source may be purchased and applied at the rate of 0.3 pound (slightly less than 1/2 cup) per 20 pounds of dry waste material. Ammonium sulfate fertilizer is another nitrogen source. Add it at the rate of 0.7 pound (slightly less than 1 cup) per 20 pounds of dry waste matter. This is especially appropriate for plants requiring acid soils.

The presence or absence of acids (**pH**) in your compost heap is another important ecological factor. Generally a pH range from 6-8 is necessary for optimum microbial decomposition of your organic debris. Many acids are present in organic residues, and it is possible to decrease decomposition by a low pH. Therefore, ground limestone, crushed clam or oyster shells, egg shells, wood ashes, or bone meal may be added to neutralize acidic conditions. For instance, if you use ammonium sulfate as a nitrogen source, add an equal amount of one of the above materials to neutralize the acidity (low pH) related to sulfate. If not neutralized, too much ammonium sulfate will cause the death of earthworm and other important soil invertebrate populations. Urea, conversely, produces slightly basic (high pH) conditions which are more optimal for decay. Incidentally, a good source of wood ashes is the residue from your barbecue grill or fireplace.

ARRANGEMENT OF LAYERS FOR COMPOSTING



REPEAT THIS THREE LAYER SCHEME UNTIL PILE IS 3-5 FEET HIGH.

Moisture requirements

Decomposer organisms require conditions of high moisture, but they cannot withstand being submerged. Here you can observe a vital relationship between organisms and a physical factor — water. Too much water will replace air in the spaces between residues. Consequently, aerobic microflora and fauna will die or become dormant due to lack of oxygen.

Control this problem by sprinkling each layer of waste material with a fine spray of water. But, be careful the debris is not soggy. Frequently debris on the bottom of the heap will get too wet. Reduce such excess moisture by turning the pile. Fresh green wastes like grass cuttings will require little or no additional water. Drying may also be a problem particularly with small heaps. Add water whenever the heap appears too dry — maybe every 2 weeks. Generally, a 50 to 70 percent moisture content in your compost pile is best.

In summary, you must maintain a delicate balance of moisture. If the compost heap is too dry, decomposition will cease; if too wet, nutrients may be lost by leaching and offensive odors will be produced.

Aeration

Organisms that do not need gaseous oxygen are called **anaerobic,** whereas, plants and animals requiring oxygen are known as **aerobic.** Since complete composting is caused by aerobic forms, adequate circulation of air is essential. Proper moisture levels and turning maintain and promote an aerobic micro-environment within the pile. Remember also, to make openings in compost containers or bins for air circulation and drainage. Another method is to stack your organic debris around and on top of wooden poles which are pulled out later providing aeration channels through the heap. The lack of oxygen is usually caused by packed or matted materials and too much water. Anaerobic organisms grow well under these conditions. They produce putrid odors from gases such as ammonia and hydrogen sulphide, and decomposition is incomplete. Obviously, you must minimize the anaerobic state within your compost heap.

Inoculum or "compost starter"

Your compost pile will be naturally inoculated with a variety of necessary decomposer organisms. Spores, eggs and dormant stages (propagules) of decomposers are always present in soil, on surfaces of organic debris and even on household wastes. Packages of compost inoculum are available on the market, but controlled scientific tests show no increased benefits over natural sources.

Heat production

Much heat energy is released by microorganisms as decay occurs. This is a signal the C:N ratio is satisfactory and composting is progressing well. Microorganism populations are growing actively. Organisms that grow best at normal summer temperatures are called **mesophilic** forms. Early decay processes will be caused by mesophilic bacteria and fungi at an optimum temperature range from 77-86°F (25-30°C). As temperatures rise to 112 or 150°F (45-65°C), populations of **thermophilic** (heat loving) bacteria, fungi and actinomycetes begin to increase and take over decomposition. At these high temperatures, population numbers may be more than 10 billion microorganisms per gram of debris. As suggested, the temperature pattern is affected by the size of materials, nitrogen concentration and moisture content.

During this heating period, soil invertebrates will either die, become dormant or migrate away from the heated center. They may move to cooler sites in the periphery of the pile. But, soil animals will again colonize these areas after the heated conditions cease.

Organisms of the Compost Microcommunity

By now, you can appreciate the role of decomposers in composting. Another complexity of this microcommunity is the vital dependence of all organisms upon each other. Organisms exhibit a network of specific feeding habits called a **food web.**

Presence of a carbon and nitrogen source stimulates growth and digestion of wastes by fungi, bacteria and actinomycetes. Cellulose decomposition by these microorganisms occurs soon after the compost pile is established. Fungal mycelia quickly penetrate all parts of the heap. Early fruiting bodies of mesophilic fungi grow on the surface, and later, thermophilic actinomycete colonies may give the surface a grey appearance. At the same time under mesophilic conditions, mites (acarines), millipedes (diplopods), sow bugs (isopods), snails and slugs (gastropods) ingest plant tissues. Soft tissues of decaying plants and animals support growth of round worms (nematodes) and potworms (enchytraeids). Minute flies (dipterans) lay eggs which hatch into larvae that feed on wastes. Earthworms ingest, digest and reshape organic matter. Maximum microorganism growth then results from this perforation and diminution of debris. This group of organisms is called the first level consumers in the decomposer food web. They feed or digest the basic carbon sources that you deposited.

With so much food available, first level consumer populations could continue to increase until the efficiency of the microcommunity would be lost and the delicate balance would be disrupted. As with most natural systems, the compost microcommunity possesses some balancing elements. First level consumers attract and become the food of second level consumers. Other mites and springtails (collembolans) eat fungi. Tiny feather-winged beetles (ptiliids) feed on fungal spores. Nematodes ingest bacteria. Protozoa and rotifers present in water films feed on bacteria and plant particles. Predaceous mites and pseudoscorpions prey upon nematodes, fly larvae, other mites and collembolans. Free-living flatworms (turbellarians) ingest gastropods, earthworms, nematodes and rotifers. Third level consumers such as centipedes (chilopods), rove beetles (staphylinids), ground beetles (carabids) and ants (formicids) prey on second level consumers.

Fecal material from primary decomposers is ingested by other decomposer organisms. Also, fecal pellets are sites for increased microorganism growth. As food items pass down the gut of animals, minute quantities of metabolites accumulate in the excreta. Metabolites in feces provide added nutrition for all types of decomposers.

Finally, after each decomposer dies all the nutrient constituents in its tissues such as nitrogen are again recycled into other organisms.

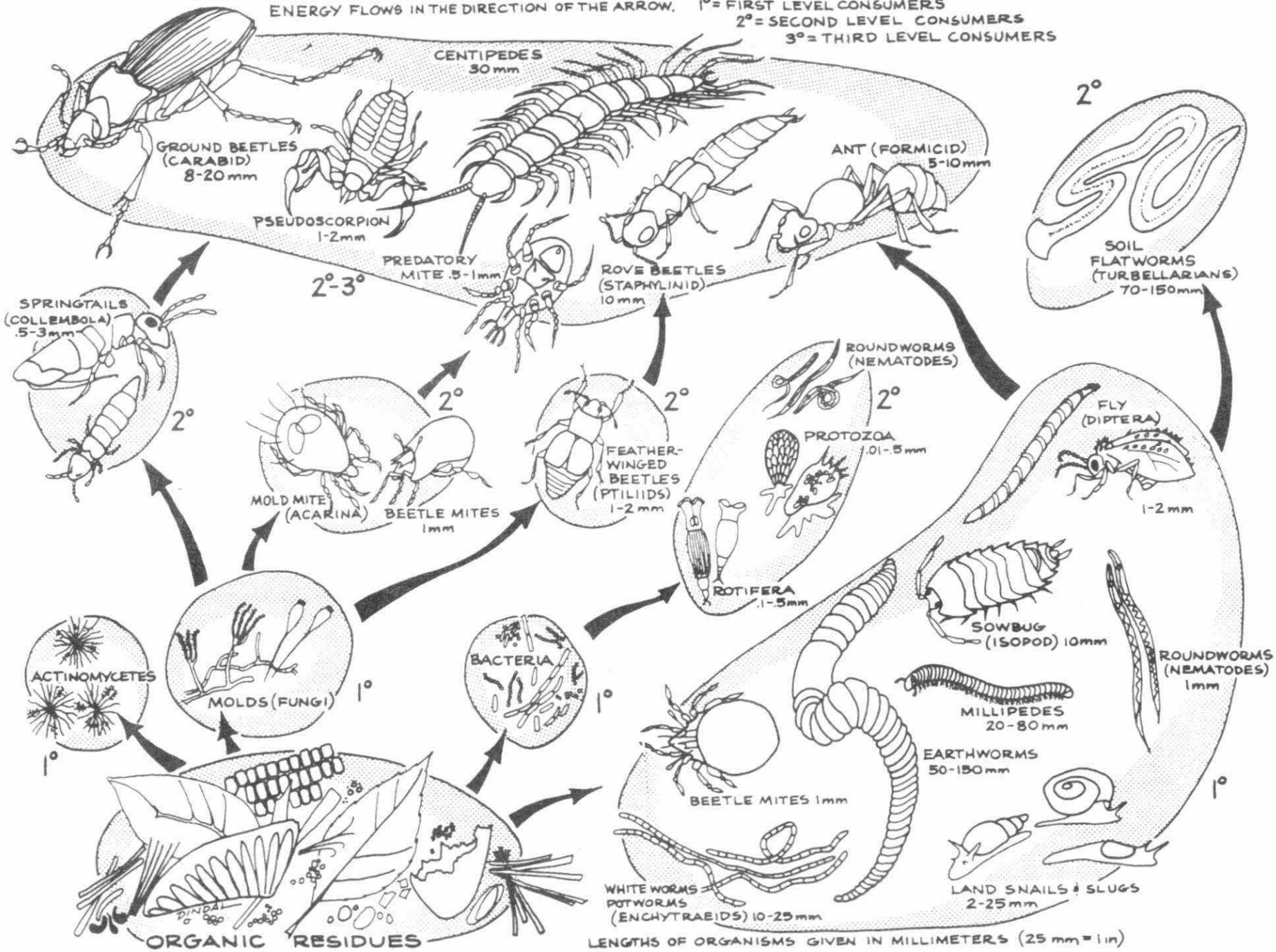
You can observe these detailed functions of this microcommunity by conducting a simple experiment. Enclose a leaf in a plastic mesh bag and place it within the compost pile. Periodically observe it closely. Watch the progress of micro-animals and plants as the leaf becomes skeletonized. Keep a record of types of organisms you see. Their pattern of appearance (or **succession**) and their role in decomposition has been repeated innumerable times in forest soils over thousands of years.

Precautions Against Pests

You have just seen why numerous decomposer plants and animals are necessary in composting. Not all organisms, however, are welcome in your compost pile. Compost heaps will not become pest reservoirs if the pile is made and maintained properly. The nature of the pest problem will depend upon where you live. Consult local community rulings regarding garbage disposal related to pest problems. In urban areas, disturbance by stray dogs and rats should obviously be discouraged. Several methods are effective. Use a minimum of meat scraps or bones. When used, grind or powder them finely. Incorporate the ground material deep within the pile

FOOD WEB OF THE COMPOST PILE

ENERGY FLOWS IN THE DIRECTION OF THE ARROW. 1°= FIRST LEVEL CONSUMERS
2°= SECOND LEVEL CONSUMERS
3°= THIRD LEVEL CONSUMERS



so they are well covered. Secondly, modifications may be built into your compost bin if you anticipate pest problems. Covers or lids can be used providing aeration is sufficient. This may also keep small piles from drying out so quickly.

Plant residues infected with insect pests or plant diseases should not be used. However, some workers have shown that the hot phase of decomposition destroys pests and disease organisms as well as weed seeds. Also, there is evidence that antibiotics are produced by fungi and actinomycetes within decaying vegetable matter. These may act as natural pest control substances. Finally, if a major plant disease or pest is a problem in your area, a formaldehyde solution (formalin) treatment of compost is recommended before using it.

Pesticide applications are not recommended for compost piles. Many are persistent. Fungicides and insecticides disrupt the structure of the microcommunity in various ways. Normal composting processes may not occur and effects cannot be predicted.

Uses of Developed Compost

Compost is ready to use when the temperature within the pile drops back to that of the surrounding air. At that time, it is finely divided, crumbly in your hand and darker in color. It also has a C:N ratio ranging from 10:1 to 20:1.

Developed compost is used as mulch around trees or shrubs or is worked into the soil. Mix thoroughly with soil for gardens, potted plants or new lawns. Application rates depend on the condition of your soil and may vary from 1 to 10 bushels per 250 square feet. It may be applied several times a year or whenever needed.

SUMMARY

As you finally incorporate the compost into the soil, you are truly a part of the ecological community of your area. Waste materials are reused. Organic matter and nutrients are recycled. You have helped alleviate the solid waste problem. You are working in harmony with the living phase of the soil, and valuable decomposer organisms are replenished. Soil is improved. Lawns, flowers, gardens and shrubs should benefit. You have become more closely related to the organisms and physical environment around you.

The content of this fact sheet was taken from the publication Ecology of Compost by D.L. Dindal, with permission of the State University of New York College of Environmental Science and Forestry, Syracuse, New York.

COMPOSTING

POSSIBLE PROBLEMS AND SOLLUTIONS

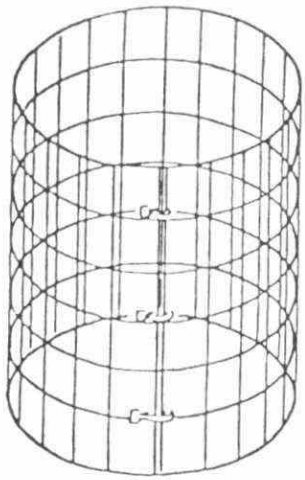
SYMPTOMS	CAUSE	CURE
bad odour with flies	too much nitrogen (produces ammonia)	turn heap and add more carbon (sawdust, newspaper, leaves)
	too much water, not enough oxygen generates conditions which produce the odour of ammonia	add dry, absorbent material (sawdust, shredded newspaper, etc.) and turn heap
the compost heap does not heat up	not enough nitrogen - heap is moist but not decomposing - too much material high in carbon (leaves, paper, straw, sawdust or cornstalks present in heap)	add nitrogen source (kitchen wastes, blood meal, green grass clippings, weeds, humus, soil or farm wastes)
	too dry	add water until material is moist but not saturated
	pile too small	save waste in plastic buckets or garbage bags and add to pile
	too wet: material in heap is soggy	turn heap and add dry absorbent material (e.g., sawdust, shredded newspaper, etc.)
slow to decompose	materials too large for efficient decomposition	speed up decomposition by shredding waste, i.e., run mower over leaves, crush egg shells, etc.

PARTIAL LIST OF WHAT NOT TO COMPOST

grass clippings which have been treated with an insecticide or herbicide
diseased or pest-ridden plant materials
coal ashes - charcoal from your barbecue
woody twigs
grease, oil or animal fat (e.g., bacon grease)
thorny bushes like raspberries or roses - the thorns are too hard to decompost and will rise again to prick you when you are handling your compost
non-organic materials (glass, metals, etc.)
plastics
bones, meat, fish scraps or fat
rhubarb and walnut leaves - they contain toxic acid which impedes the growth of micro-organisms and plants

EXAMPLES OF SOME HOME COMPOSTERS

FOR DO-IT-YOURSELFERS



Woven wire fencing, held together by several small chain snaps, makes the quickest and most economical compost bin.

(Rodale, 1969)

Instructions:

- when enclosure is half full, drive a wooden or steel stake through the middle into the ground beneath
- top of stake should be as high as the pile is intended to be
- remove fencing when pile is ready to turn and set it up near the heap within easy shovelling distance
- pull stake out of centre and start turning by slicing downward on the outside of the heap
- if a second heap is planned, remove fencing and set up at a new site, leaving the stake in the first pile to prevent caving or falling apart
- during dry spells, dig out a depression and pour water into pile

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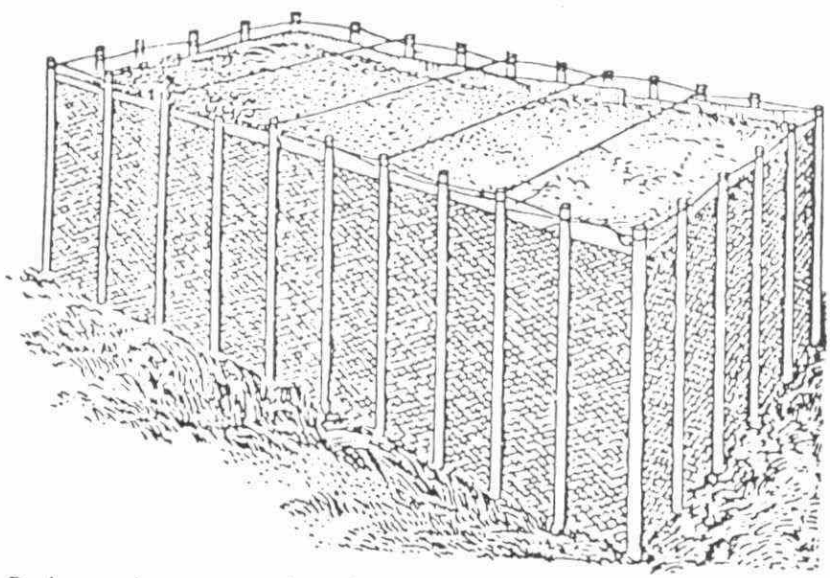


Poultry netting, tomato stakes, about 60 feet of soft iron baling wire—that's all you need to make a container that can hold about 150 cubic feet of compost. Corrugated cardboard, placed inside netting, keeps compost from drying out.

(Rodale, 1969)

Instructions:

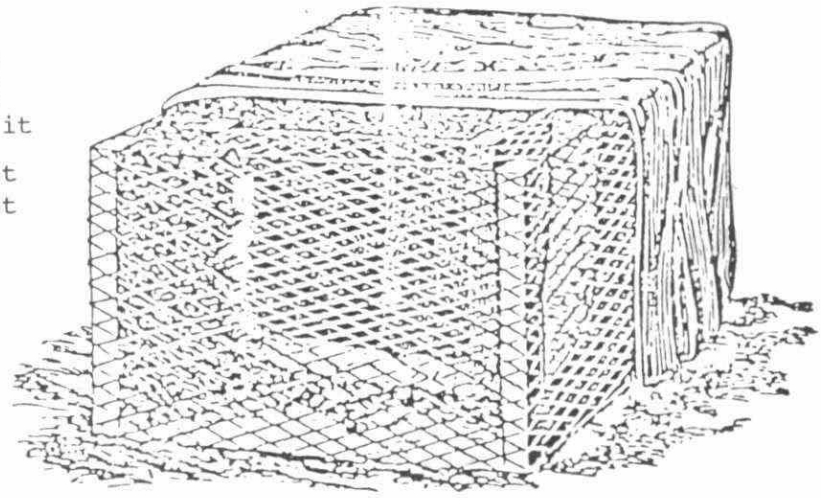
- materials needed - 30 ft. ½" mesh poultry netting, 30 1" sq. tomato stakes, 60 ft. soft iron baling wire
- mark off rectangle - 10'x5'
- drive tomato stakes in about 6", one foot apart
- loop baling wire around top of each stake
- place poultry wire inside stakes and hold in place by inserting small pieces of soft wire through loops at top and around post
- spread lengths of baling wire across alternate pairs of stakes to prevent sides from bulging

- - - - -

- to prepare compost, layer: 6" organic waste; 2" manure; 1" soil; sprinkling of lime
- turn after five weeks by dismantling enclosure in the reverse order to that described above
- set up in new place and shovel compost in.

Instructions:

- set up four posts surrounded by poultry netting and build a small compost pile within it
- surrounding this enclosure at a distance of 1½ to 2 ft. set up another four cornered enclosure of wire into which is dumped excess leaves, grass, weeds, etc. until it is as high as the inner compost pile
- cover inside pile with a thick layer of leaves sloping to a peak at the centre
- cover with a tarpaulin of burlap bags sewn together roughly



An insulated compost bin will help you make compost right through the coldest months of winter. Insulating material can be made up of leaves, straw and burlap—all held in place by poultry netting fastened to the 4 wooden posts.

(Rodale, 1969)

- weight or tie them around the edges and leave until the spring
- the leaves will be partly broken down and ready to be used in new piles
- the centre pile is composted and ready to be used

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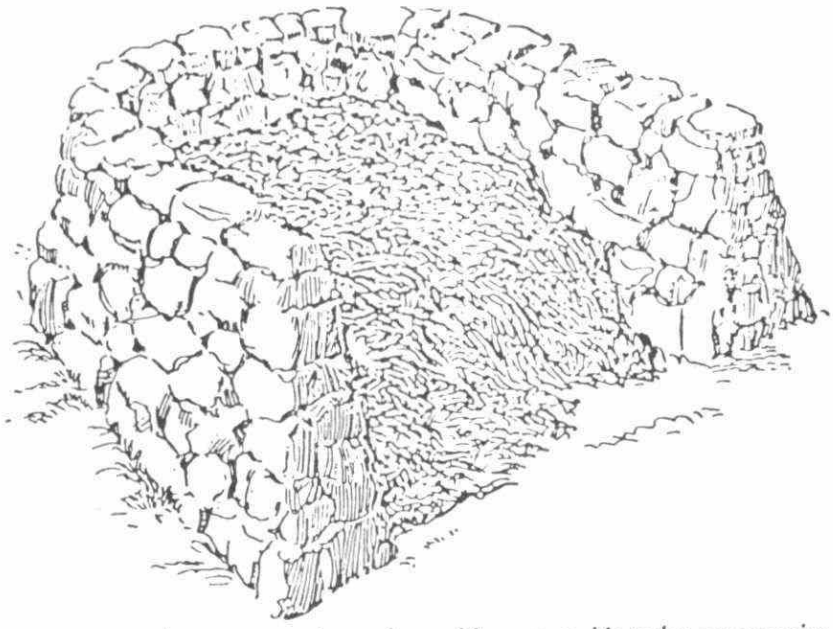
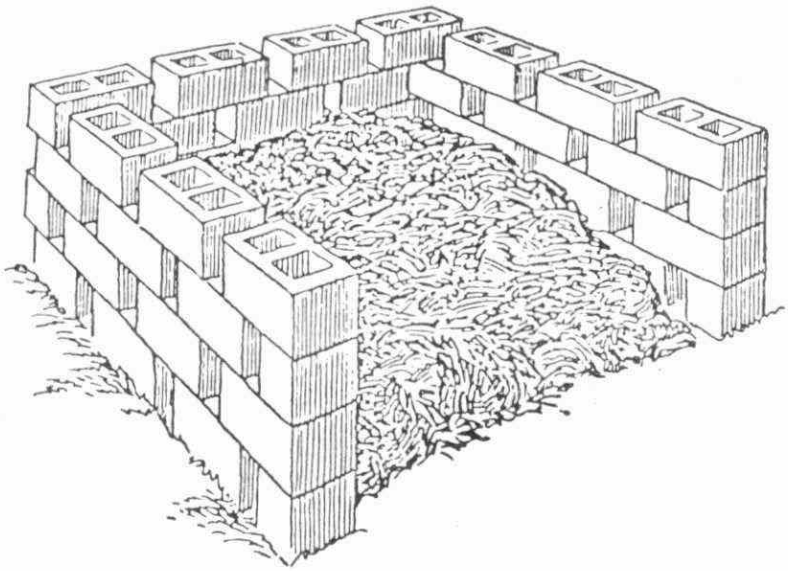


Rough stone enclosure as one shown above with an open side makes an attractive, informal appearance, is easily accessible for piling materials for composting. A bin of this type makes a fine camouflage for the suburban gardener's compost heap.

Instructions

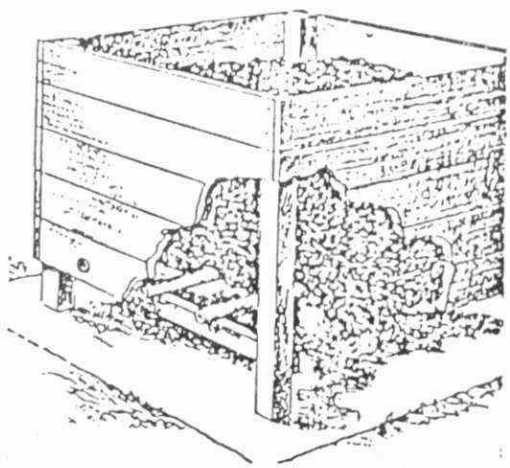
- simply heap stones ensuring spaces are left between them to permit aeration
- leave one end open for easy access to the compost.

(Rodale, 1969)



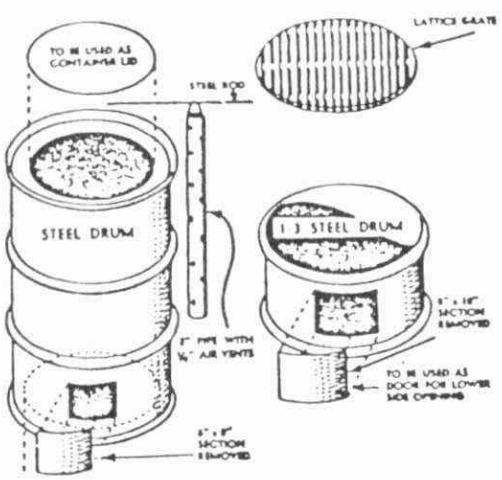
Block or brick bin is easily constructed with concrete blocks or bricks, laid without mortar. Blocks are laid to permit plenty of aeration spaces. This bin is sturdy, durable, easily accessible with its open end, can be built to match a brick house.

(Rodale, 1969)



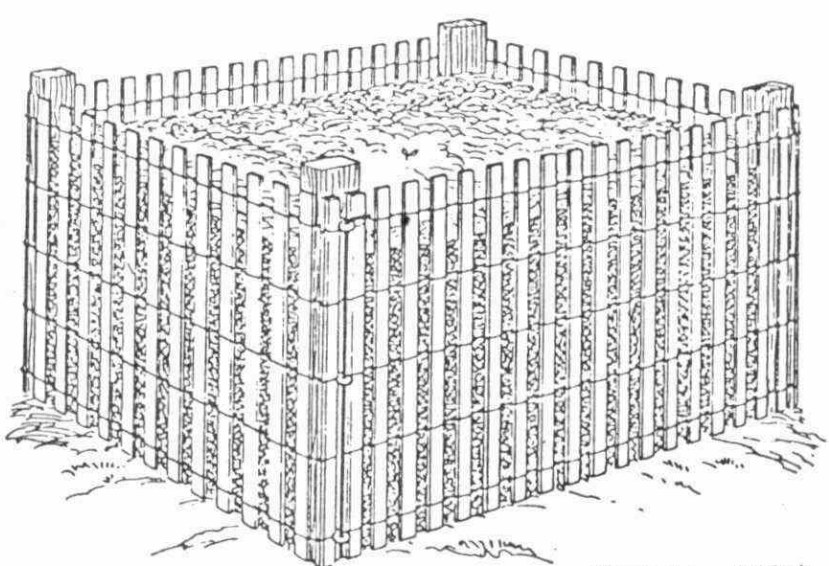
(Franz Maurice,
Rodale Press)

F. W. Bassett got air into the center of his pile by setting it on a pipe grid about ten inches above the ground. The same results have been obtained with a wood and wire base.



Ralph Roe's compost-drum is actually two drums, with the smaller nested in the larger. Air penetrates the center of the pile through a perforated tubing.

(Franz Maurice,
Rodale Press)

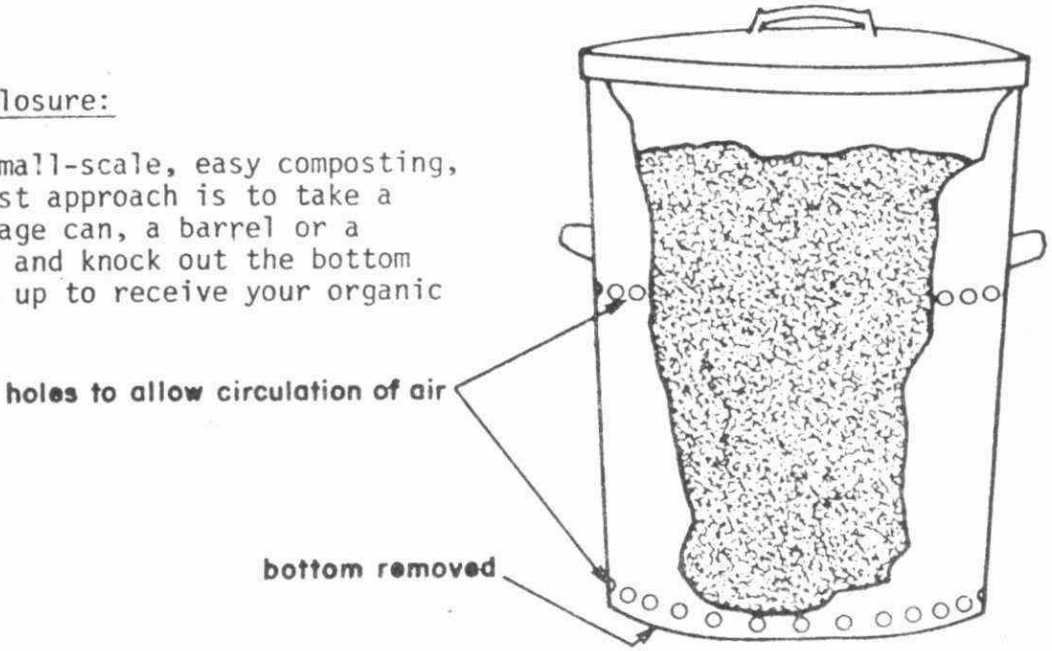


(Rodale, 1969)

Picket fence bins have always been popular because of their simplicity, satisfactory appearance, and ease of building, moving and storing when not in use. To build a picket bin, buy sections of prefab fencing and fasten in a square, as shown.

Simple enclosure:

For small-scale, easy composting, the simplest approach is to take a large garbage can, a barrel or a wooden box and knock out the bottom and set it up to receive your organic wastes.

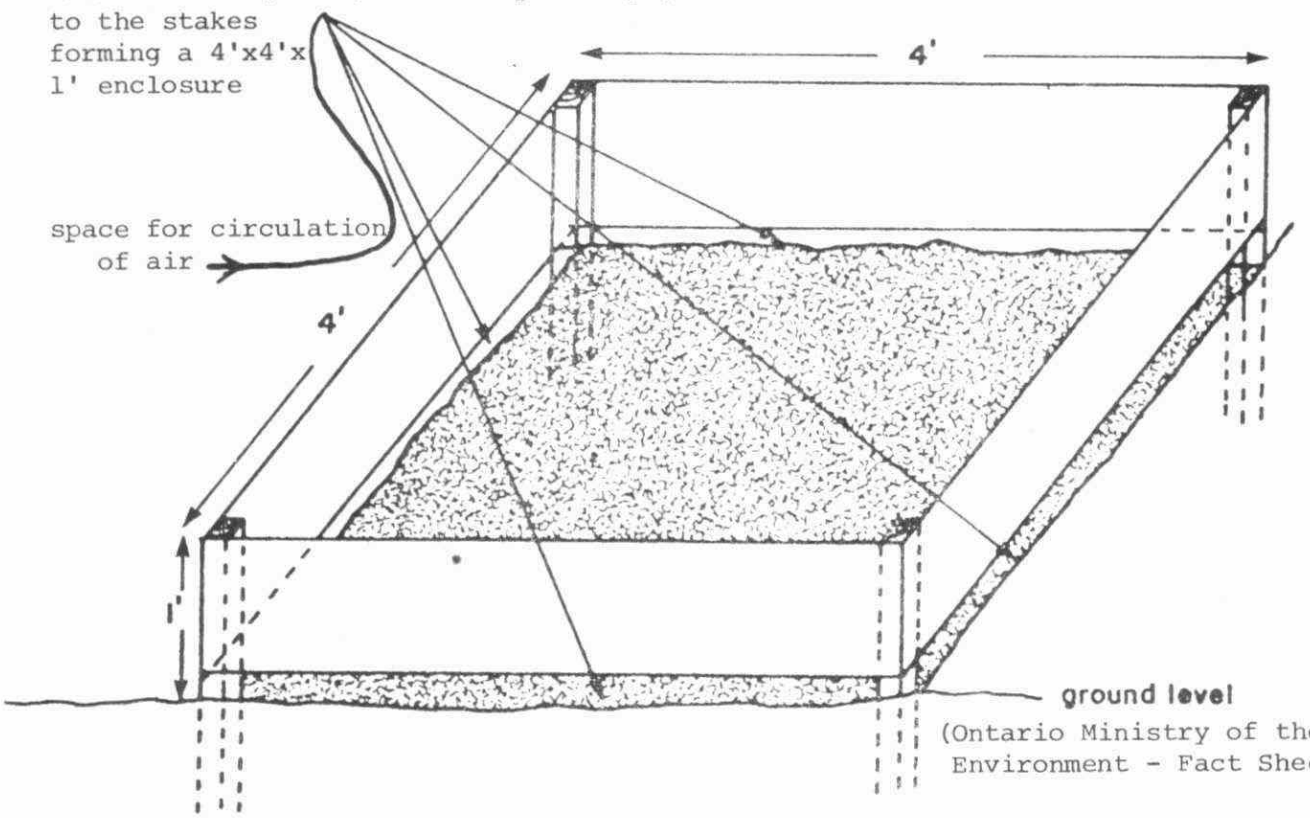


(Ontario Ministry of the Environment - Fact Sheet)

Custom enclosure:

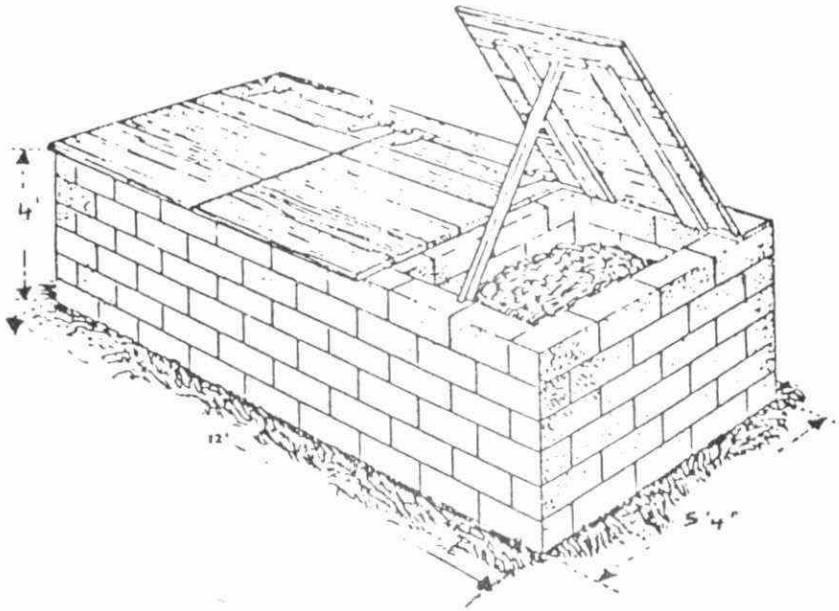
A composting enclosure can also be tailor-made in any size. These directions show how to build an enclosure four feet square rising one foot above ground level.

- mark off a 4' square on the ground and dig a pit between 12" and 18" deep
- the pit provides some warmth in the winter months and keeps the compost damp in summer
- drive four stakes approx. 2" square by 2' long into the ground at the corners leaving 1 foot of stake above the ground
- from a sheet (8'x4') of ¼" aspenite plywood, cut four 1'x4' rectangles and nail them to the stakes forming a 4'x4'x 1' enclosure



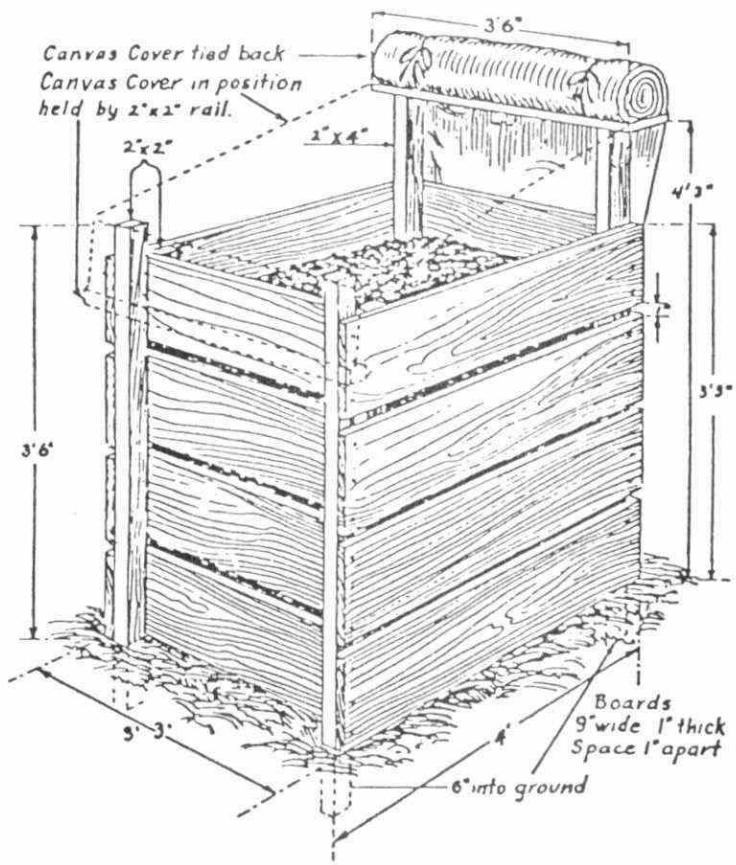
(Ontario Ministry of the Environment - Fact Sheet)

- leave approx. 1" space around bottom so that air can circulate up through the heap - the remaining half of the sheet will be used as a cover for your heap during winter
- in summer, a sheet of heavy gauge plastic placed on a 4'x4' frame of 2" stock will be used as a cover to prevent moisture loss and insect breeding.



Many gardeners who prefer the "well-groomed" bin make use of a long, 3-compartment brick enclosure with wooden roofs. Fresh organic matter is placed in the first compartment and as this decomposes, the material is turned and placed in the second bin. The third bin is reserved for finished compost.

(Rodale, 1969)



Removable front allows for free access for turning material while open sides permit good air circulation. The simple roll-back canvas cover, such as the one shown on the above bin, will protect the compost from the sun and heavy rainfall.

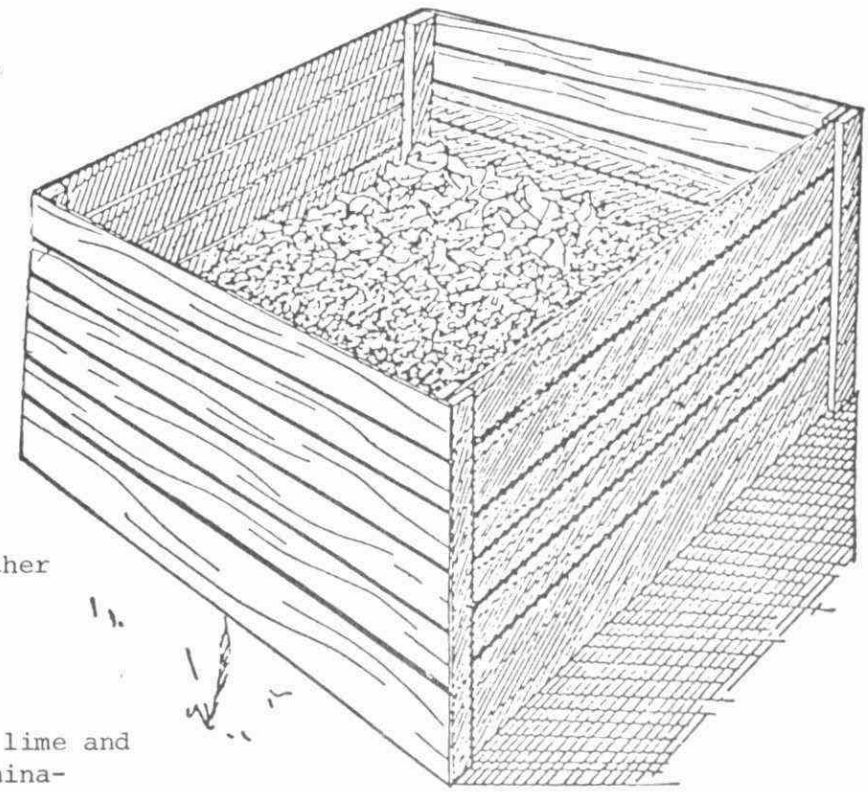
(Rodale, 1969)

Instructions:

Simplest Design - (yields 1 ton of compost)

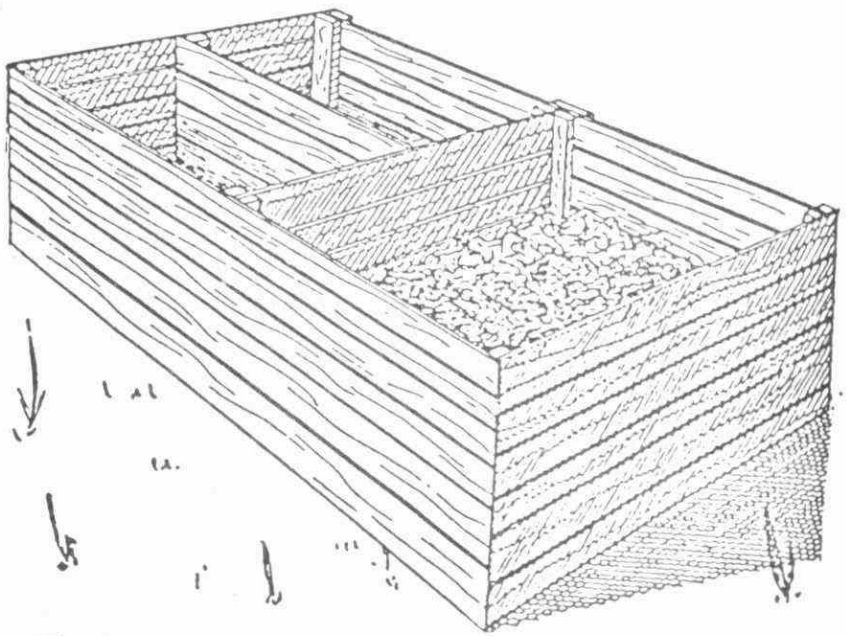
- wooden structure 4' square by 3' high with neither top nor bottom;
- sides are pieces of wood 6" wide x 1" thick;
- leave 1" between each board for aeration;
- boarding in front slides down between two posts for easy access;
- framework is held together by 2x4's.

- - - - -



To compost:

- mix greenmatter, soil, lime and manure thoroughly, eliminating layers of material;
- make one air hole in centre of box all the way to the ground with crowbar;
- cover top with burlapping or make burlap frame with ½" mesh wire;
- when turning material it must be taken out of the box in a pile and returned.



The New Zealand Box is a simple wooden structure 4 feet square x 3 feet high without any top or bottom layers. Front boards slide down between two posts so the compost can be more easily turned or removed. Framework is 2 x 4's.

(Rodale, 1969)

OR

- build a double sized box 8x4 feet square;
- fork material from one section into another;
- place a new batch into the first section;
- it is therefore a continuous process where only one turn is given.

OR

- build a three section box 12'x4';
- it is started in section A, turned into B, a new batch being made in A;
- when B is turned into C, then A is turned into B and a new batch made in A;
- the process is continuous.

A PARTIAL LIST OF MATERIALS SUITABLE FOR COMPOSTING

algae (pond weeds)
apple pomace (cider press waste)
artichoke leaves
ashes (from wood, corncobs, fruit skins etc.)
asparagus tops (chopped)
banana skins
bean shells
bean plants
beet tops
birdcage cleanings
broccoli stalks (shredded or or cut)
buckwheat hulls
buckwheat straw
cabbage stalks and outer leaves
cocoa hulls
carrot tops and scrappings
castor pomace
cat litter (pyrophyllite and vermiculite)
cauliflower leaves
citrus wastes and rinds
clover (red, green and sweet)
hay (mixed grasses or salt marsh hay)
hedge clippings
hemp waste
hops, spent (brewery waste)
incinerator waste (less metal and other nonbiodegradable matter)
kelp (seaweed)
kitchen refuse (less animal fat)
leaf mold
leather waste and dust
leaves (all varieties)
lettuce
lime (agricultural)
limestone (ground)
marble dust
rhubarb leaves
rice hulls
sawdust (weathered, hardwood and soft)
shavings, wood
shells, ground (clam, crab, lobster, mussle, oyster, etc.)
silk mill waste
sludge (processed sewage — where suitable)
squash waste (vines, leaves)
soybean straw
sphagnum moss
sugar cane residue (bagasse)
takage (slaughter house refuse)
coffee wastes and grounds
corn cobs (shredded and chopped)
corn stalks (shredded)
cottonseed hulls
cotton waste ("gin trash")
cow peas
cucumber vines
dolomite
earthworms
eel grass
egg shells (ground or crushed)
feathers
felt waste
fish scraps (heads, tails, innards)
fish, "trash" (suckers, dace, etc.)
flowers
gelatine plant waste
grape pomace (winery waste)
granite dust
grass (rye, timothy, etc.)
grass clippings (lawn)
greensand
hair
milk (sour — whole or skim)
muck (marsh and swamp mud, dried)
muskmelon (vines, leaves and rinds)
olive residues
oat straw
peanut hulls
pea waste (pods and vines)
peat moss
phosphate rock
phosphorous (superphosphate)
pine needles (white, red, cedar, etc.)
potash rock
potato wastes (leaves, stalks and skins)
tannery waste
tea leaves
tobacco waste (stalks and stems)
tomato plants and stems
turnip tops (rutabaga tops)
vetch
watermelon waste (vines, leaves and rinds)
weeds
wheat straw
whey
wood chips
wool (waste and rags)

Source: Campbell, S. 1975, Let it Rot, 152pp, Garden Way, Charlotte, VT.

COMPOSTING

SIMPLE RECIPE

Your pile up the ingredients
Supply the necessary water, air, and (if desired) a commercial accelerator, and then wait for the microorganisms to do their work to decompose it all

Your pile will heat up, and then breaks down, cools off and after six to eight weeks will supply a dark, mellow product, ideal for improving soil

Just about anything you pull up, hoe out, prune, rake, mow or clip in a garden can go into your HUMUS MAKER.

Composting is best started in the spring and summer, when your garden can supply you with a steady supply of waste material.

If you begin in the fall with the remains of summer flowers and vegetables, leaves, etc., your pile will age over the winter, well protected from the elements in your HUMUS MAKER.

Odours develop if your pile doesn't receive enough air, and caused anaerobic bacteria.

With your HUMUS MAKER, it is engineered in such a way that it lets in the correct amount of air and encourages aerobic bacteria which do not smell bad

HUMUS MAKER

- **"WHAT IS COMPOST"?**

composting is a natural process that started with the first animals and plants on the planet earth and has been going on ever since.

Microorganisms, earth worms, insects, birds, all have a large part in rotting down material that is dead. It could take centuries to make 2 or 3 inches of organic topsoil.

The man-made compost pile bring together the right materials and create the proper conditions for decomposing waste into available food for all the plants and vegetables in your garden.

The compost you make with your "Humus Maker" from waste will prove to be valuable material tat will benefit plants and vegetables grown in your garden and house.

- **THINGS TO REMEMBER ABOUT COMPOST**

Compost is a food that your plants can readily use. The microbial action brings about the decomposition and releases the nutrients in the waste which are readily absorbed by your plants and vegetables.

Compost made from a proper variety of garden/kitchen waste material can supply your plants and vegetables with all the nitrogen, phosphorus and potassium and many other elements needed for nutrition. The fibres in the rich compost also make an excellent soil conditioner which encourages water absorption, lossens the soils and prevent erosion, cracking and caking.

Garden material, lawn clipping, prunings, leaves and other organic products that were once a nuisance and considered "worthless" can now be recycled into a rich compost that will enhance your soil and make your garden into a show-place.

Compost is a natural substance and is not artificial in any way. You can use as much as you make and it will not harm the plants or vegetables in your garden.

Composting is fun and not hard to make if you follow the instructions - and remember, to give back to the land as vital as taking from it. Composting is a method of using up things we have an abundance of such as: garden and kitchen waste

- **SIMPLE STEPS IN MAKING COMPOST**

The modern practice of composting is a speeding up and intensifying the natural process which needs **warmth, moisture** and **air** (oxygen) for the microorganisms to do their decomposting work. Provide these ingredients and you will be successful in making compost

1. Preparation of Raw Material
The materials to be used for composting such as lawn clipping, tree leaves should be mixed together as thoroughly as possible. This will give proper ventilation, moisture and help spread the microorganisms throughout the pile. Avoid letting one kind of material get concentrated in any one part of the pile, as this may form a mat and stop the composting activity

2. Moisture Content
A good rule of thumb to follow is that the material is sufficiently moist if the surface of the particles glistens. An excessive amount of moisture will cause and offensive odor and will halt the activity by a drop in the heat of the pile. Inspect the pile frequently. Moisten with your garden hose as necessary.

HOW TO USE FINISHED COMPOST

Compost is ready to use when it cools off and turns crumbly and dark brown. Use it to improve soil's moisture - holding capacity, to aid aeration, water penetration, to reduce surface crusting. Compost supplies nutrients as it continues to decompose. If it is used before it is ready it will draw nutrients from the soil instead. To build up soil for flowers and vegetables shovel a one or two inch layer of compost on garden beds and mix into the top four to six inches of soil. Do this about four to six weeks before planting. Compost can be used as a side dressing around flower and vegetables already planted. Spread it lightly over a lawn after aerating or scaling it. Put down an inch of compost around trees and shrubs and renew it once a year. Compost can be used to make a rich potting mix with equal parts of sand and topsoil.

Dr. Neal Stoskopt, Professor of Crop Science and director of the Associate Diploma Program at the Ontario Agricultural College of the University of Guelph had edited the text and endorsed the use of the "Humus Maker" as a source of compost for the home owner.

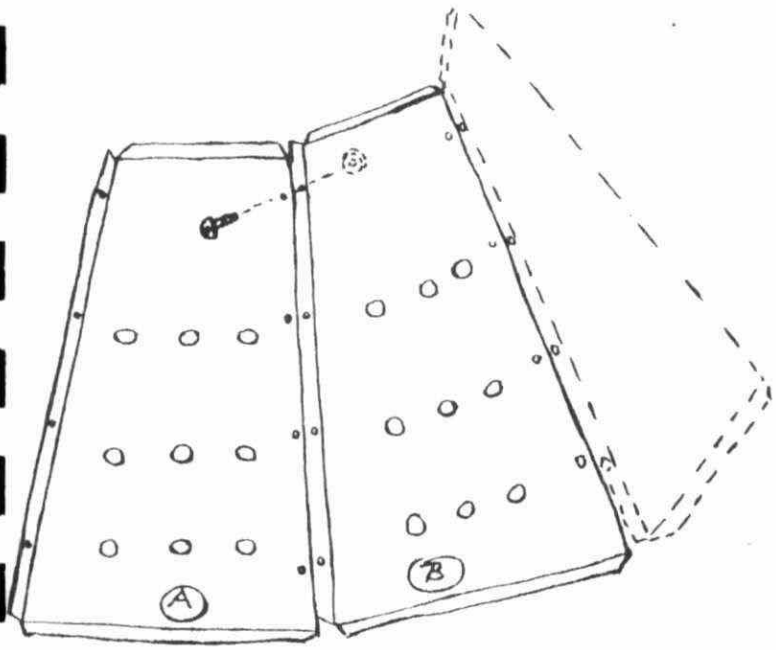


FIG 1

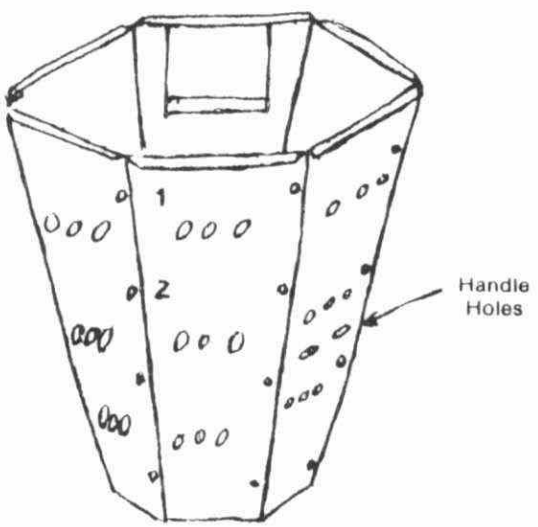


FIG 2

ASSEMBLY INSTRUCTIONS FOR THE HUMUS MAKER.

Place two panels toghether so that broken edge of panel B is flush with unbroken edge of panel A **Fig. 1**

Line up screw holes and push through screw as show.
Run nut onto screw - finger tight.
Repeat above
Procedure in subsequent holes.
Continue the same assembly for additional panels.

When assembly last panel insert and tighten top two screws and nuts turn Humus Maker lip side down and install final two screws.

While Humus Maker is up side down **Fig. 2** tighten # 1 & #2 screws on each panel with screw driver, holding nuts with wrench or pliers.

Turn Humus Maker right side up tighten remaining screw same as above.

Slide in door.

Spring in handles.

NOTE: Your "Humus Maker" is made out of vinyl covered steel. This means it will not break due to normal handling and will not crack due to weather conditions.

3. Aeration
In order that the microorganisms can do their work the right amount of oxygen is necessary. Too little air will cause an unpleasant odor. You "Humus Maker" is engineered with holes, that let in the correct amount of air. Air will naturally penetrate half a meter from all directions.

4. Heat
The temperature inside the pile (about 10 to 15 inches from the surface) should rise to 43°C to 49°C within 48 hours after starting the process. It should reach 55°C and higher within several days after the start. The heat brings more rapid decomposition and also serves to kill weeds, seeds, roots and diseased plants. It is important to prevent any loss of heat and this is accomplished by the walls of the "Humus Maker" which insulates the pile.

- **MATERIAL TO BE USED FOR COMPOSTING**

Just about anything that can be pruned, raked, mowed, reaped or weeded. Avoid evergreens - (this material does not compost readily). Refuse from the kitchen, such as: coffee grounds, orange and lemon peels, egg shells (broken down) and all vegetable wastes can be used. Man-made products such as: plastics, nylons will not decompose.

Do not make a compost pile from leaves only or grass clippings. These materials have a tendency to mat together, exclude the oxygen and stop the composting process. However, when mixed together with other materials, they will compost without any problem. The cool remains of a wood fire (ashed) and charcoal used in your barbecue can be used, at they are rich in potash.

- **Feeding Your "Humus Maker"**

One of the best methods is to feed your "Humus Maker" on a weekly basis by mixing your grass clippings thoroughly with other available material, then moisten and add an activator on the layer. This will get the fermentation off to a good start and also build up the necessary amount of heat.

Kitchen waste can be added whenever the need arises, however, you should be sure to cover with grass of leaves so that insects such as flies are kept away.

- **Activators**

Activators in the pile can make a big difference. They are an extra source of nitrogen which can be added to give the microorganisms a head start. Animal manure is a good source of nitrogen, or a handful of organic fertilizer such as bone meal or fish meal. Several commercial activators are sold for this purpose. These can be found in most Garden Centers and Department Stores.

PILE CONSTRUCTION

The structure of the pile does not have to be built in any exact way, but should be built to create the conditions necessary for a quick and thorough decomposition of the waste material that is fed to the compost pile.

1. Choose a site that is close to an ample supply of water and to an area you will be using the compost. It should also be protected from the wind and direct sun. Keep away from low lying areas in your garden.

2. Dig the ground over lightly, for drainage. This will also encourage earthworms to move up into the pile.

3. Provide an air supply channel at the bottom.

4. Start the pile with about 3 or 4 inches of well rotted manure or some old compost material. Make sure this material is loose enough so that it will not block the bottom air ventilation channel. If none of these materials are available, use some coarse chopped vegetation so that the air will circulate readily.

5. Add a six inch layer of premixed and moistened material.

6. A handful of activator can be sprinkled over the layer.

7. Add another six inch layer of premixed material.

8. If you plan to add more materials to your compost pile, a temporary covering of plastic can be used. However, if you have completed the pile top it off with two inches of soil. This will hold in the heat and help reduce evaporation.

The compost pile can be started in the spring and continued through the summer months when the garden has continuous supply of waste material. However, it isn't too late to begin in the fall with the remains of summer flowers and vegetables, leaves, etc. The compost pile will age over the winter, and will be well protected from the elements in your "Humus Maker".